Dual Pulsed Pump Laser for Trace Gas Detection, Phase I

Completed Technology Project (2018 - 2019)

Project Introduction

Fibertek proposes to develop a novel space-qualifiable, double pulse 1064 nm laser and related technologies for use as a pump laser in airborne and space-based trace gas lidar remote sensing systems. The goal is an injection seeded laser system with two closely spaced (~100-200 µs), 600 mJ pulses at 50 Hz that is an innovative synthesis of both new and recently developed Fibertek technologies. The primary application of this dual pulse system is for use as a pump laser in Differential Absorption Lidar systems that require one pulse that is in resonance with the molecular species being detected and one that is off resonance. For the pump laser we will develop, the two pulses need to be closely spaced in time so they sample essentially the same atmospheric aberrations. These performance goals exceed the requirements for pulsed lasers in the 20 Hz to 100 Hz repetition rate range with energies greater than 100 mJ that is identified in the 2018 SBIR subtopic S1.01, Lidar Remote Sensing Technologies. The combination of high pulse energy, dual-pulse injection seeded format, and pure conductive cooling makes these state of the art design goals. This technology could be the pump source for optical parametric oscillators (OPOs) and other wavelength converters needed for lidar based remote detection of key of atmospheric gases including methane, ozone, and water vapor. The design will advance the state of the art in laser performance by ***decreasing the size by 2x and increasing the efficiency by over 80%*** in a purely conductively cooled package needed for space-based applications compared to other recently developed systems.

Anticipated Benefits

Two major limiters of lidar remote sensing systems are the size and power consumption of the laser transmitter. The high-efficiency, compact MOPA we will develop can significantly reduce the size and weight of a space-qualifiable laser that can be the pump transmitter for airborne and space-based lidar measurements including:

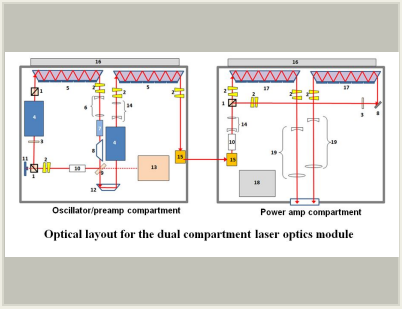
1) Ozone DIAL systems

2) Water vapor and methane DIAL systems

3) Next-generation cloud, aerosol, and ocean lidar systems

4) Direct detection wind measurement systems.

There is a significant commercial interest in the high-efficiency, compact laser being proposed. The applications include 1) as an upgrade to Optical Autocovariance Wind Lidar (OAWL) system and 2) as the transmitter needed for wind lidar used by DoD for precision air drop missions. The higher energy, higher efficiency, and reduced size of the laser transmitter will improve the efficiency, reduce the size, and extend the range and applicability of both types of systems.



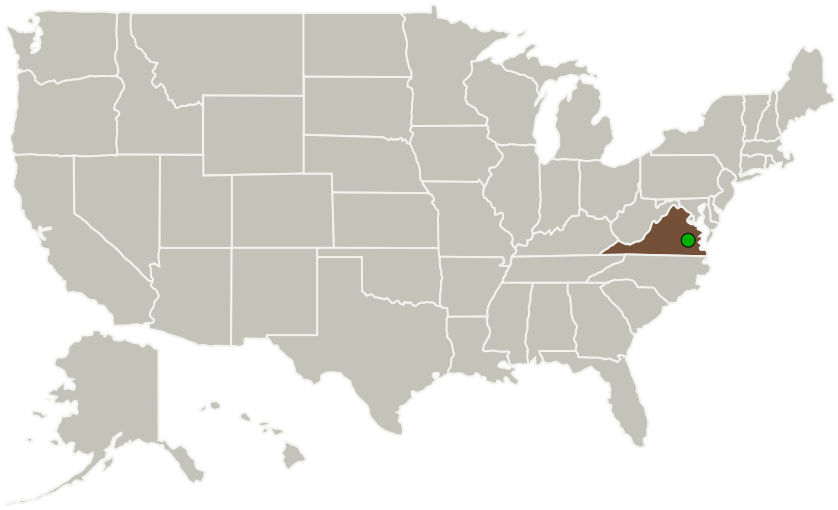
Dual Pulsed Pump Laser for Trace Gas Detection, Phase I

Table of Contents

Dual Pulsed Pump Laser for Trace Gas Detection, Phase I

Completed Technology Project (2018 - 2019)

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Fibertek, Inc.	Lead Organization	Industry	Herndon, Virginia
Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations
Virginia

Project Transitions

July 2018: Project Start

February 2019: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/141020)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Fibertek, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

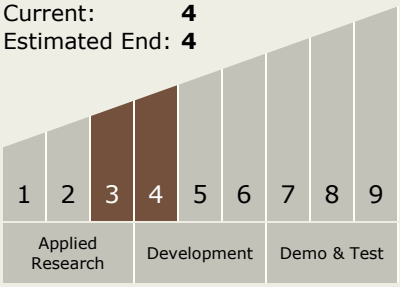
Carlos Torrez

Principal Investigator:

Floyd Hovis

Technology Maturity (TRL)

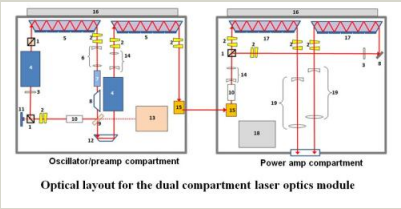
Start: **3**
Current: **4**
Estimated End: **4**



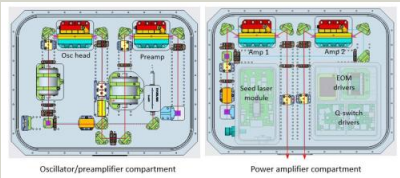
Dual Pulsed Pump Laser for Trace Gas Detection, Phase I

Completed Technology Project (2018 - 2019)

Images



Briefing Chart Image
Dual Pulsed Pump Laser for Trace Gas Detection, Phase I
(https://techport.nasa.gov/image/128268)



Final Summary Chart Image
Dual Pulsed Pump Laser for Trace Gas Detection, Phase I
(https://techport.nasa.gov/image/128160)

Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.5 Lasers

Target Destination

Earth